VERIFICATION

I, Shin-Sook LEE, residing at Jewoo Building 6th fl, 200, Nonhyun-Dong, Kangnam-Ku, Seoul, Republic of Korea do hereby certify:

THAT I am a Technical Translator of documents including Patent Specifications;

THAT I have good knowledge of both the Korean and English Languages;

AND THAT, to the best of my knowledge and belief, the attached document is a true and correct translation of Korean Patent Application Serial No. 81446/2002 titled "METHOD FOR FORMING PATTERN USING PRINTING PROCESS".

Dated: September 29, 2005

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(Typed Name)

Lee
(Signature)

[SPECIFICATION]

[Title of the Invention]

METHOD FOR FORMING PATTERN USING PRINTING PROCESS

[Brief description of the Drawings]

Figure 1 is a plane view showing a structure of a general liquid crystal display device.

Figure 2 is a cross-sectional view in line I-I direction showing a thin film transistor and a storage capacitor of the liquid crystal display device shown in Figure 1.

Figure 3 illustrates sequential processing of a method for forming a pattern in a photo-mask process according to the related art.

Figure 4 illustrates sequential processing of a method for forming a pattern using a gravure offset printing method as an embodiment of the present invention.

Figure 5 is a view showing another embodiment of the present invention.

Figures 6A and 6B are views showing still another embodiment of the present invention.

**** Explanation for the major reference numerals ****

100, 200 : cliché	107 : resist pattern
110 : doctor blade	120, 220 : printing roll
120a, 220a : blanket	131 : etching object layer

[Detailed description of the invention]

[Object of the invention]

[Field of the invention and background art]

The present invention relates to a method for forming a pattern using a printing process, and particularly, to a method for forming a pattern which is able to solve a problem of uneven pattern generated as a substrate becomes larger.

In display devices, particularly in flat panel display devices, pixels are arranged in a matrix. Further, in flat panel devices, such as LCD devices, an active device, such as Thin Film Transistors (hereinafter, TFTs) are positioned in respective pixels for driving the pixels in the display devices. This method of driving the display device is called the active matrix driving method because the active devices are arranged in the respective pixels aligned in a matrix form.

Figure 1 is a plan view of a pixel in a related art LCD device using the active matrix method. The active device is a TFT 10. As shown in FIG. 1, gate lines 2 arranged lengthwise and data lines 4 arranged widthwise define a pixel. The TFT 10 for independently controlling the driving of the respective pixel is formed near where one of the gate lines and one of the data lines cross over each other. The TFT 10 includes a gate electrode 2a, which is connected with one of the gate lines 2, a semiconductor 5 that is formed on the gate electrode 2a, and source and drain electrodes 4a and 4b that are formed on the semiconductor layer 5.

The TFT 10 is activated when a scan signal is applied to the gate electrode 2a by one of the gate lines 2. In the pixel, a pixel electrode 7, which is connected to the drain electrodes 4b, is supplied with an image signal through the source and drain electrodes 4a and 4b when the semiconductor layer 5 is activated by the gate electrode 2a.

The pixel electrode 7 is connected with the drain electrode 4b through the first contact hole 8a. A storage line 6 and a storage electrode 11, which overlaps the storage line 6, are positioned in the pixel defined by the gate line 2 and the data line 4 to form a

storage capacitor Cst. The storage electrode 11 is connected with the pixel electrode 7 through a second contact hole 8b.

Figure 2 is a cross-sectional view taken along section line I-I' of Figure 1 showing a TFT 10 and storage capacitor Cst positioned inside the pixel. As shown in FIG. 2, the TFT 10 includes a substrate 1 made of transparent insulating material, such as glass, a gate electrode 2a formed on the substrate 1, a gate insulating layer 13 deposited over the entire substrate 1, a semiconductor layer 5 formed on the gate insulating layer 13 and source/drain electrodes 4a and 4b formed on the semiconductor layer 5, and a passivation layer 15 formed on the source/drain electrodes 4a and 4b to protect the device, and a pixel electrode 7 connected with the drain electrode 4b through the first contact hole 8a.

The storage capacitor Cst includes a storage line 6 formed during the same series of patterning processes as the gate electrode 2a of the TFT, and a storage electrode 11 formed during the same series of patterning processes as the source and drain electrodes 4a and 4b. A gate insulating layer 13 is formed between the storage line 6 and storage electrode 11. A second contact hole 8b for exposing a part of the storage electrode 11 is formed in the passivation layer 15. The storage electrode 11 is electrically connected with the pixel electrode 7 through the second contact hole 8b. The storage capacitor Cst charges via a gate voltage while a gate signal is applied to the gate electrode 2a, and then holds charge until the gate electrode 2 is selected in the next frame to prevent voltage change of the pixel electrode 7.

The LCD device as above is fabricated by a photo-mask process, and the photo-mask process comprises a series of processes such as photo-resist application, arrangement and exposure, development, cleaning, etc..

Figure 3 illustrates sequential processing of a method for forming a pattern in a photo-mask process according to the related art.

First, as shown in Figure 3A, a substrate 30 including an etching object layer is provided, and a photo resist layer 31 of polymer resin is evenly applied on the substrate 30 through a spin coating or a roll coating method. Next, as shown in Figure 3B, the photo resist layer 31 is blocked by a mask 33 on which non-transparent area for the light is selectively formed, and then, UV (arrow in Figure) is radiated to expose the photo resist layer 31 except the blocked area. Next, as shown in Figure 3C, the photo resist layer 31 on which the ultraviolet ray is radiated is developed to form a photoresist pattern 31a selectively remained on the substrate 30. After that, the etching object layer (not shown) formed on the substrate 30 is etched by using the photoresist pattern 31a as a mask, and therefore, the desired pattern is formed.

However, according to the related photo-mask process, equipment of high price such as the mask and the exposing apparatus is required, and therefore, the production cost is increased. Also, it is difficult to align the mask and the substrate exactly due to the limitation of the exposing apparatus in the exposure process.

Therefore, there is a limit to form a fine pattern requiring high degree of accuracy. Moreover, since the exposure area of the exposing apparatus in the photo process of the display device, the screen should be divided and the photo process is proceeded in order to fabricate the display device of larger area. Therefore, the photo process should be repeated a plurality of times, and therefore, the productivity is lowered and it is difficult to meet the need of larger substrate.

[Technical gist of the present invention]

Therefore, an object of the present invention is to provide a method for forming a pattern which is able to form a pattern on a display device of larger area by one-time process according to a printing method.

Also, another object of the present invention is to prevent a printing equipment from being enlarged for proceeding with a printing process by dividing a substrate which is becoming large in size, and form a uniform pattern over the entire substrate.

The objects and features of the present invention will be described in detail through the below construction and claims of the present invention.

[Construction of the present invention]

To achieve the above object, there is provided a method for forming a pattern including: a step of providing a substrate on which a plurality of unit panels and etching object layers on the respective unit panel areas are formed; a step of dividing the substrate into a plurality of divided areas so as to include at least one or more unit panel; a step of providing a cliché on which a plurality of grooves are formed; a step of filling resist in the grooves of the cliché; a step of providing a printing roll having same width as that of the divided area of the substrate; a step of transferring the resist filled in the groove of the cliché onto a surface of the printing roll by contacting and rotating the printing roll on the cliché; and a step of applying the resist transferred on the surface of the printing roll on the etching object layer.

In addition, according to the increase in size of substrates, a substrate is divided into two or more regions and a printing process is repeatedly performed on each divided region, thereby preventing enlargement of a printing equipment, namely, a cliché and a printing roll, and enhancing uniformity of a pattern formed entirely on the substrate.

The method for forming a pattern according to a printing method in accordance with the present invention will now be described with reference to the accompanying drawings.

Figure 4 illustrates sequential processing of a method for forming a pattern using

a gravure offset printing method as an embodiment of the present invention

To begin with, as shown in Figure 4A, a cliché 100 having concave groove 102 formed on a position corresponding to the pattern which will be formed on the substrate is provided, and then, resist 103 is applied thereon. After that, a doctor blade 110 is contacted to the surface of the cliché 100, and then, is pulled evenly to fill out the resist 103 in the groove 101 and to remove the resist remained on the surface of the cliché 100.

As shown in Figure 4B, the resist 103 filled in the groove of the cliché 100 is transferred onto a surface of a printing roll 120 which is contacted and rotated on the surface of the cliché 100. A blanket 120a is applied on the surface of the printing roll 120 for improving adhesive force with the resist 103 and to separate the resist 103 from the cliché 100 smoothly. In addition, the blanket 120a is formed to have same width as that of the panel on the display device, and to have similar circumference to the length of the panel. Therefore, the resist 103 filled in the groove 101 of the cliché 100 can be transferred all onto the circumferential surface of the printing roll 120.

After that, as shown in Figure 4C, the printing roll 120 is rotated in the state that the resist 103 transferred on the printing roll 120 is contacted to a surface of the etching object layer 131 formed on the substrate 130, and accordingly, the resist 103 applied on the printing roll 120 is transferred to the etching object layer 131. In addition, UV or heat is radiated to the transferred resist 103 to dry the resist, and thereby, a resist pattern 107 is formed. At that time, the pattern 107 can be formed on the etching object layer 131 of the display device with one rotation of the printing roll 120.

As described above, the cliché 100 and the printing roll 120 can be fabricated according to the size of desired display device in the printing method, and the pattern can be formed on the substrate with one transferring. Therefore, the pattern for the display device of larger area can be formed with one process.

The etching object layer 131 may be a metal layer for forming metal pattern such as the gate electrode, the source/drain electrodes, the gate line, the data line of the thin film transistor or the pixel electrode and storage electrode, or may be an insulating layer such as SiOx or SiNx.

After forming the resist pattern 107 as above on the metal layer or on the insulating layer, the metal layer or the insulating layer is etched in a general etching process to form the metal layer of desired pattern (that is, electrode structure) or the insulating layer (for example, the contact hole, etc.).

According to the printing process, the resist pattern can be formed on the substrate with one process, and especially, the processes are simpler than those of the related art and the processing time can be reduced.

However, the resist should be formed on the substrate with one process in the above printing method, and therefore, the sizes of the cliché, the printing roll 120 and the blanket 120a should be increased as the substrate becomes larger. Therefore, a large space is required to print the pattern on the substrate as the equipment becomes larger. Moreover, as the size of the printing roll 120 is increased, the weight of the printing roll 120 is also increased, and therefore, it is difficult to ensure the uniform pressure compressed by the printing roll 120 on the entire substrate 130.

In addition, as the substrate is distorted according to changes of processing temperature during the processes such as depositing and etching processes, alignment between the substrate and the printing equipment is twisted since there is no apparatus which is able to compensate the distortion. In more detail, the substrate generally used to fabricate the LCD device is product of Corning, etc., and it is distorted according to the temperature change. Especially, as the size of the substrate becomes larger, the changed amount of the substrate according to the temperature change is more increased. Table 1

shows maximum changed amount according to the temperature change for 1737 model and Eagle2000 model compared by sizes of substrates. As a reference, thermal expansion rate of the 1737 model is 37.8 x 10^{-7}/°C, and the thermal expansion rate of the Eagle2000 model is 31.8 x 10^{-7}/°C.

[table 1]

Temperature changed amount (°C)	Size of substrate(mm)	Maximum deformation (μm) of substrate	
		1737	Eagle2000
1	300	1.1	1.0
	600	2.3	1.9
	1,000	3.8	3.2
	1,500	5.7	4.8
5	300	5.7	4.8
	600	11.3	9.5
	1,000	18.9	15.9
	1,500	28.4	23.9
10	300	11.3	9.5
	600	22.7	19.1
	1,000	27.8	31.8
	1,500	56.7	47.7

At that time, the maximum changed amounts of the two models for the temperatures changing of 1°C, 5°C and 10°C were measured according to sizes of the substrates, that is, 300mm, 600mm, 1000mm and 1500mm. At that time, the unit for the deformation amount is μm. In the detailed description, the deformation amount according

to the temperature change in 1737 model in case of 300mm and 1500mm will be described.

First, when the temperature is changed about 1°C, the deformation amounts of 300mm and 1500mm substrates are 1.1μm and 5.7μm respectively, and when the temperature is changed about 5°C, the substrates are deformed about 5.7μm and 28.4μm. On the other hand, in case that the amount of temperature change is 10°C, the 300mm substrate is deformed about 11.3μm and the 1500mm substrate is deformed about 56.7μm. As shown in the experimental result, as the size of the substrate is increased, the deformation amount of the substrate for the temperature change is increased in proportion to the increased size.

As described above, since there is no deformation of the cliché and the printing roll compensating the deformation despite that the size of the substrate is changed according to the temperature change, the misalignment is caused.

Therefore, the present invention provides a method for forming the pattern which is able to keep up with the larger substrate and the temperature change to solve the above problems. That is, the substrate is divided into at least one or more unit panel, and after that, the printing roll or the cliché is fabricated according to the divided regions, and therefore, the uniformity of the pattern for entire substrate can be ensured.

Figure 5 is a view showing a method for forming pattern suitable for the larger substrate. As shown therein, the cliché 200 is divided into 6 areas A1 ~ A6, and the substrate (hereinafter, referred to as mother glass) 250 is divided into 6 areas A1' ~ A6' so as to correspond to the divided areas of the cliché 200, then, the printing roll 220 suitable for the respective divided area is disposed. At that time, one unit panel 251 is included in one divided area, and the printing process is additionally proceeded for the respective unit panel 251.

First, the resist filled in the A1 is transferred onto a surface of the blanket 220a of the printing roll 220, and then, applied onto the A1' area of the mother glass 250. At that time, the printing roll 220 prints the resist on the A1' area by one rotation. Therefore, the blanket 220a is formed to have same width as that of the unit panel 251 formed on the A1' area, and is formed to have a circumference of same length as that of the panel, but it is not mandatory. However, the blanket 220a should not be over the divided area of A1'. The patterns formed on the A2 ~ A6 areas of the cliché are same as those formed on the A1 area, and therefore, the patterns are formed on the remained areas A2' ~ A6' by repeating the above process.

As described above, when the substrate is divided into a plurality of areas and printed, the area of the substrate on which the printing is proceeded actually is reduced, and therefore, the deformation amount of the substrate according to the temperature change can be reduced. That is, as described above, as the size of substrate is reduced, the deformation amount according to the temperature change is reduced, and thereby, the misalignment can be reduced in the printing process. Moreover, as the size of the printing roll is reduced, the fabrication cost is reduced and the uniformed pattern can be formed throughout the entire substrate.

On the other hand, the cliché and the substrate can be divided so as to includes at least two or more unit panels. That is, as shown in Figures 6A and 6B, the mother glass 260 is divided in a width direction, and the two unit panels 261 disposed upper and lower sides are made as one unit and the printing process is proceeded thereon, then, the pattern can be formed on entire mother glass 260 with rotating the printing roll for three times. At that time, the entire area of the blanket should be same as the divided area B including the two unit panels. Also, as shown in Figure 6B, when the mother glass 270 is divided in a length direction and the three unit panels 271 disposed from the left to the right are

made as one unit and the printing process is performed, the pattern can be performed on entire mother glass by rotating the printing roll for twice. And at that time, the entire area of the blanket should be same as the divided area C including the three unit panels.

In addition, the cliché can be simplified in order to reduce the space occupied by the printing apparatus. That is, the cliché is fabricated to have same size as that of the divided area on the substrate, and therefore, the material cost can be reduced and the efficiency of the space utility can be improved.

[Effect of the invention]

As so far described, according to the present invention, the resist pattern is formed by one printing process, and therefore, the processing equipment can be simplified as comparing to that of the related photo-mask process and the processing time and cost can be reduced to improve the productivity. Also, according to the present invention, the printing area is divided to prevent the printing apparatus from becoming larger as the substrate becomes larger to reduce the material cost, and the misalignment can be reduced as the printing area is reduced. Therefore, the uniformity of the pattern formed on entire substrate can be improved.

What is claimed is:

1. A method for forming a pattern comprising:

a step of providing a substrate on which a plurality of unit panels and etching object layers on the respective unit panel areas are formed;

a step of dividing the substrate into at least two or more areas;

a step of filling resist in grooves of a cliché corresponding to a position of a pattern to be formed on the substrate;

a step of transferring the resist filled in the groove of the cliché onto the etching object layer of the substrate by the divided area unit.

2. The method of claim 1, wherein the step of applying the resist on the etching object layer comprises:

a step of providing a printing roll having same width as that of the divided area of the substrate;

a step of transferring the resist in the groove of the cliché onto a surface of the printing roll by contacting and rotating the printing roll on the cliché corresponding to the divided area of the substrate; and

a step of applying the resist transferred on the surface of the printing roll on the etching object layer.

3. The method of claim 2, wherein a blanket is applied on the surface of the printing roll for applying the resist onto the etching object layer smoothly.

4. The method of claim 3, wherein the length of the blanket, that is, the

length of the circumference is same as that of the divided area on the substrate.

5. The method of claim 1, wherein the divided area of the substrate includes at least one or more unit panels.

6. The method of claim 1, wherein the cliché is formed to have same size as that of the divided area on the substrate.

7. The method of claim 1, wherein the cliché is formed to have same size as that of the area divided by units of unit panel.

8. The method of claim 1, wherein the etching object layer includes a metal layer.

9. The method of claim 1, wherein the etching object layer includes an insulating layer made of SiOx or SiNx.

10. The method of claim 1, wherein the etching object layer is a semiconductor layer.

11. A method for forming a pattern comprising:

a step of providing a substrate on which a plurality of unit panels and etching object layers on the respective unit panel areas are formed;

a step of dividing the substrate into a plurality of divided areas so as to include at least one or more unit panel;

a step of filling resist in grooves of a cliché corresponding to a position of a pattern to be formed on the substrate;

a step of providing a printing roll having same width as that of the divided area of the substrate;

a step of contacting the printing roll on the cliché corresponding to the divided are of the substrate and rotating it to transfer the resist filled in the groove of the cliché onto a surface of the printing roll; and

a step of contacting the resist transferred on the surface of the printing roll on the etching object layer, and rotating it to re-transfer the resist to the etching-object layer.

[Translation]

ABSTRACT OF THE DISCLOSURE

[Abstract]

A method for forming a pattern by using a printing process includes: providing a substrate on which a plurality of unit panels and etching object layers on the respective unit panel areas are formed; dividing the substrate into a plurality of divided areas so as to include at least one or more unit panel; filling resist in grooves of a cliché corresponding to a position of a pattern to be formed on the substrate; providing a printing roll having same width as that of the divided area of the substrate; contacting the printing roll on the cliché corresponding to the divided are of the substrate and rotating it to transfer the resist filled in the groove of the cliché onto a surface of the printing roll; and contacting the resist transferred on the surface of the printing roll on the etching object layer, and rotating it to re-transfer the resist to the etching-object layer.

[Representative drawing]

Figure 5

FIG. 1
RELATED ART

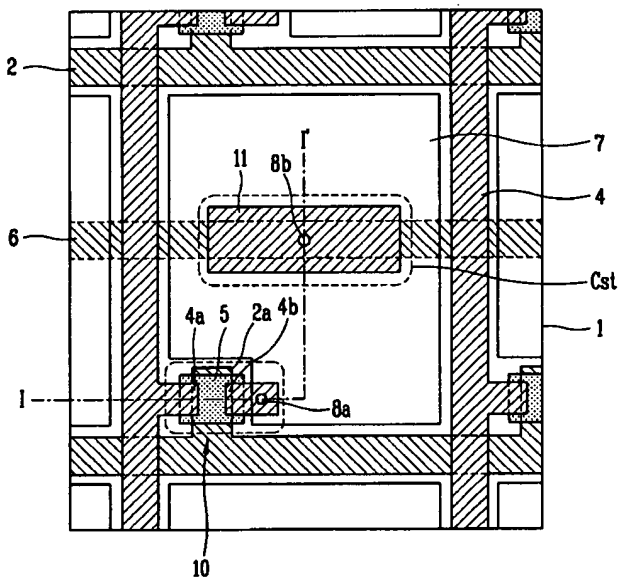

FIG. 2
RELATED ART

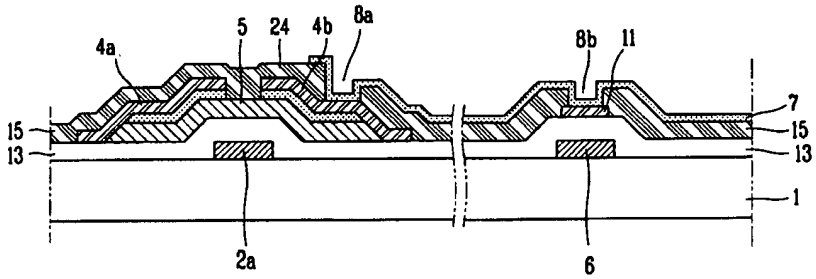

FIG. 3A

FIG. 3B

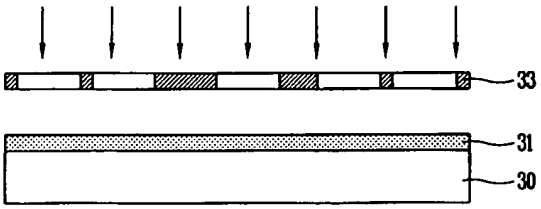

FIG. 3C

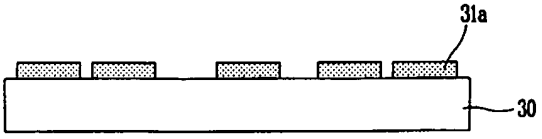

FIG. 4A

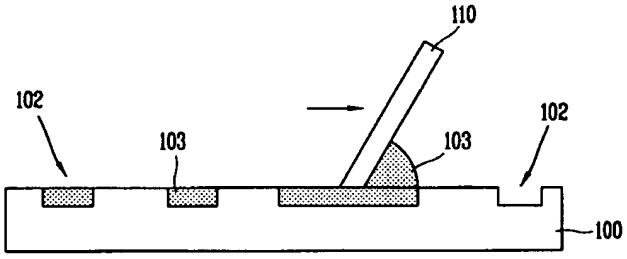

FIG. 4B

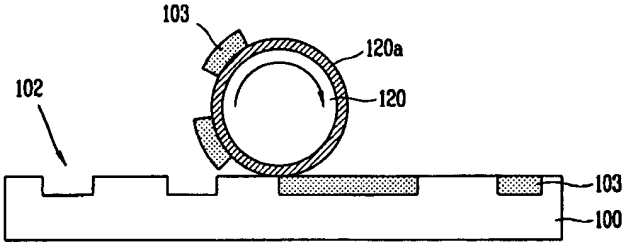

FIG. 4C

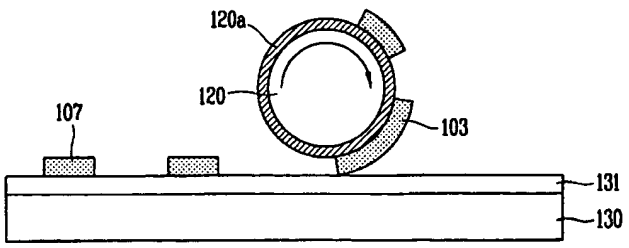

FIG. 5

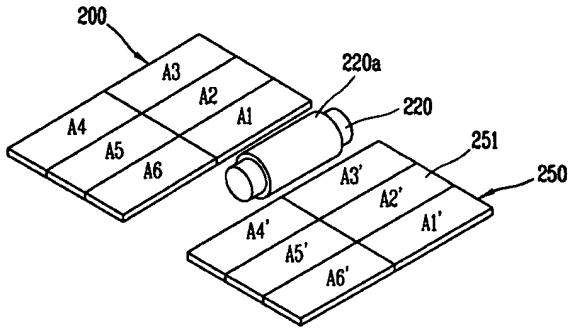

FIG. 6A

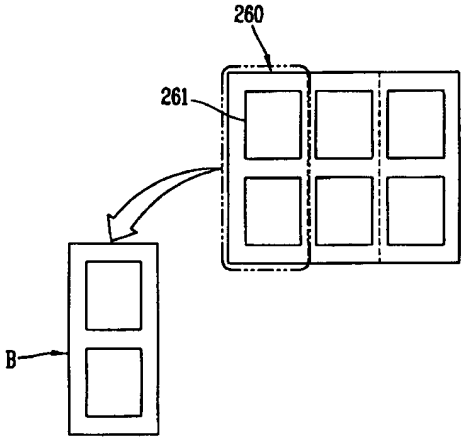

FIG. 6B